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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/482,429	01/13/2000	Gerard Joseph Foschini	10-1-3-14	6969

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Docket Administrator Rm 3C 512
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EXAMINER	
DUONG, FRANK	
ART UNIT	**PAPER NUMBER**
2666	6

DATE MAILED: 04/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/482,429	FOSCHINI ET AL.	
	Examiner	Art Unit	
	Frank Duong	2666	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE ____ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 January 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *21 and 22* is/are allowed.

6)☒ Claim(s) *1-4,6-14 and 17-20* is/are rejected.

7)☒ Claim(s) *5,15 and 16* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is a response to the amendment dated 1/5/04. Claims 1-22 are pending in the application.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 17-19 are rejected under 35 U.S.C. 102(b) as being anticipated by Whinnett (EP 0 807 989).

Regarding **claim 17**, in accordance with Whinnett reference entirety, Whinnett discloses a receiver (*Fig. 7; element 704*) for use in a MIMO system (*see Fig. 7 and page 9, line 10 to page 14, line 30*), comprising:

L antenna (768- 770);

L downconverters (780-782);

an estimator (790) for determining an estimate of an interference covariance matrix for a forward channel being received by said receivers (*see pages 10-11*); and

a transmitter (*768, 769 or 770*) for a reverse channel (feedback) for transmitting said estimate of an interference covariance matrix to a receiver for said reverse channel (see page 11, last two paragraphs).

Regarding **claim 18**, in accordance with Whinnett reference entirety, Whinnett discloses a receiver (*Fig. 7; element 704*) for use in a MIMO system (*see Fig. 7 and page 9, line 10 to page 14, line 30*), comprising:

L antenna (768- 770);

L downconverters (780-782);

an estimator (790) for determining an estimate of an interference covariance matrix for a forward channel being received by said receivers (see pages 10-11);

an estimator (790) for determining an estimate of a channel response for a forward channel being received by said receiver (see pages 10-11); and

a transmitter (*768, 769 or 770*) for a reverse channel (feedback) for transmitting said estimate of an interference covariance matrix to a receiver for said reverse channel (see page 11, last two paragraphs).

Regarding **claim 19**, in accordance with Whinnett reference entirety, Whinnett discloses a receiver (*Fig. 7; element 704*) for use in a MIMO system (*see Fig. 7 and page 9, line 10 to page 14, line 30*), comprising:

an estimator (790) for determining an estimate of an interference covariance matrix for a forward channel being received by said receivers (see pages 10-11);

an estimator (790) for determining an estimate of a channel response for a forward channel being received by said receiver (see pages 10-11); and

a weight calculator for calculating weights for use by a transmitter of said forward channel to transmit data substreams to said receiver as a function of said estimate of an interference covariance matrix for a forward channel being received by said receiver

and said estimate of a channel response for a forward channel being received by said receiver (*see Fig. 7; element 750 or 790 and pages 13-14*).

Regarding **claim 20**, in addition to features recited in base claim 19 (see rationales discussed above), Whinnett further discloses a transmitter (*768, 769 or 770*) for a reverse channel for transmitting said weights to a receiver for said reverse channel (see page 11, last two paragraphs).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-4, and 6-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paulraj et al (USP 6,351,499) (hereinafter "Paulraj") in view of Vook et al (USP 5,982,327) (hereinafter "Vook").

Regarding **claim 1**, in accordance with Paulraj reference entirety, Paulraj discloses a method for transmitting signals in communicating system (Fig. 2) having a transmitter (12) with N transmit antennas (18A-18M) transmitting over a forward channel (22) to a receiver (14) having L receiver antennas (34A-34N) and a reverse channel (Fig. 3; element 64) for communicating from said receiver to said transmitter, in which there exists correlation in the signals receives by two or more of said L receive antennas (*see col. 6, lines 4-9*) , the method comprising the steps of: determining the

number of independent signals that can be transmitted from said N transmit antennas to said L receive antenna (see col. 6, lines 26-36); creating, from a data stream (52), a data substream (SM) for each number of independent signals that can be transmitted from said N transmit antennas to said L receive antennas (*see col. 6, line 50 to col. 7, line 40*). Instead of weighting each of the substreams to individual weight unit and combining the weighted substreams for transmission, Paulraj imposes the substreams to the space-time codes containing in database 60 depending upon the communication characteristics of the channel reflected the value of the quality parameter. In other words, Paulraj fails to further disclose the claimed limitations of "*weighting each of said substreams with N weight, one weight for each of said N transmit antennas, said weights being determined by said transmitter as a function of channel information and an interference covariance matrix, to produce N weighted substreams per substream; combining one of said weighted substreams produced from each of said substreams for each of said transmit antennas to produce a transmit signal for each of said transmit antennas*". However, such limitations lack thereof from Paulraj reference are well known in beamforming network and spatial multiplexing systems and disclosed by Vook.

In the same field of endeavor, Vook discloses a base station/subscriber unit (*see '327, Fig. 9 and col. 12, lines 31-37*) comprising a weighting unit (1002) for weighting the input signals and a combiner (1004) for combining the weighted signals for transmission to maximize efficiency (*see '327, col. 2, line 21*). The forming a plurality of

weighted antenna output signals based on at least two covariance matrices and two steering vectors determined from the pilot symbols (*see abstract and thereinafter*).

It would have been obvious to those skilled in the art at the time of the invention was made to implement Vook's teaching into Paulraj's method to arrive the claimed invention with a motivation to maximize efficiency.

Regarding **claim 2**, in addition to features recited in base claim 1 (see rationales discussed above), Paulraj in view of Vook further discloses the step of transmitting said transmit signal from a respective one of said antennas (*see '499, col. 8, lines 35-40*).

Regarding **claim 3**, in addition to features recited in base claim 1 (see rationales discussed above), Paulraj in view of Vook further discloses the step of receiving said weight via said reverse channel (*see '327, Figs. 9-10 and "499, Fig. 3; element 64*).

Regarding **claim 4**, in addition to features recited in base claim 1 (see rationales discussed above), Paulraj in view of Vook further discloses said weights are determined by said transmitter as a function of channel information and interference covariance received from said receiver via said reverse channel (*see '499, col. 7, lines 7-8, col. 8, lines 47-67 and '327, Figs. 9-11 and col. 12, line 31 to col. 13, line 16*).

Regarding **claim 6**, in accordance with Paulraj reference entirety, Paulraj discloses an apparatus for transmitting signals in communicating system (Fig. 2) having a transmitter (12) with N transmit antennas (18A-18M) transmitting over a forward channel (22) to a receiver (14) having L receiver antennas (34A-34N) and a reverse channel (Fig. 3; element 64) for communicating from said receiver to said transmitter, in which there exists correlation in the signals receives by two or more of said L receive

antennas (*see col. 6, lines 4-9*) , the apparatus comprising: means for determining (26 or 60) the number of independent signals that can be transmitted from said N transmit antennas to said L receive antenna (see col. 6, lines 26-36); means for creating (28 or 58, from a data stream (52), a data substream (SM) for each number of independent signals that can be transmitted from said N transmit antennas to said L receive antennas (*see col. 6, line 50 to col. 7, line 40*). Instead of weighting each of the substreams to individual weight unit and combining the weighted substreams for transmission, Paulraj imposes the substreams to the space-time codes containing in database 60 depending upon the communication characteristics of the channel reflected the value of the quality parameter. In other words, Paulraj fails to further disclose the claimed limitations of "*means for weighting each of said substreams with N weight, one weight for each of said N transmit antennas, said weights being determined by said transmitter as a function of channel information and an interference covariance matrix, to produce N weighted substreams per substream; means for combining one of said weighted substreams produced from each of said substreams for each of said transmit antennas to produce a transmit signal for each of said transmit antennas*". However, such limitations lack thereof from Paulraj reference are well known in beamforming network and spatial multiplexing systems and disclosed by Vook.

In the same field of endeavor, Vook discloses a base station/subscriber unit (*see '327, Fig. 9 and col. 12, lines 31-37*) comprising a weighting unit (1002) for weighting the input signals and a combiner (1004) for combining the weighted signals for transmission to maximize efficiency (*see '327, col. 2, line 21*). The forming a plurality of

weighted antenna output signals based on at least two covariance matrices and two steering vectors determined from the pilot symbols (*see abstract and thereinafter*).

It would have been obvious to those skilled in the art at the time of the invention was made to implement Vook's teaching into Paulraj's system to arrive the claimed invention with a motivation to maximize efficiency.

Regarding **claim 7**, in addition to features recited in base claim 6 (see rationales discussed above), Paulraj in view of Vook further discloses the means for developing said weights (*see '327, element 1002*).

Regarding **claim 8**, in addition to features recited in base claim 6 (see rationales discussed above), Paulraj in view of Vook further discloses the means for storing said weights (*see '327, element 1002*).

Regarding **claim 9**, in addition to features recited in base claim 6 (see rationales discussed above), Paulraj in view of Vook further discloses wherein said receiver comprises means for developing said weights (*see '327, element 1002*).

Regarding **claim 10**, in accordance with Paulraj reference entirety, Paulraj discloses a transmitter (50) for transmitting signals in communicating system (Fig. 2) having a transmitter (12) with N transmit antennas (18A-18M) transmitting over a forward channel (22) to a receiver (14) having L receiver antennas (34A-34N) and a reverse channel (Fig. 3; element 64) for communicating from said receiver to said transmitter, in which there exists correlation in the signals receives by two or more of said L receive antennas (*see col. 6, lines 4-9*) , the transmitter comprising: a demultiplexer (58) for creating (28 or 58, from a data stream (52), a data substream

(SM) for each number of independent signals that can be transmitted from said N transmit antennas to said L receive antennas (*see col. 6, line 50 to col. 7, line 40*); database 60 storing parameters of suitable matrix set G(z) for any given channel conditions (*see col. 8, lines 47-50*). Instead of weighting each of the substreams to individual weight unit and combining the weighted substreams for transmission, Paulraj imposes the substreams to the space-time codes containing in database 60 depending upon the communication characteristics of the channel reflected the value of the quality parameter. In other words, Paulraj fails to further disclose the claimed limitations of "*means for weighting each of said substreams with N weight, one weight for each of said N transmit antennas, said weights being determined by said transmitter as a function of channel information and an interference covariance matrix, to produce N weighted substreams per substream; means for combining one of said weighted substreams produced from each of said substreams for each of said transmit antennas to produce a transmit signal for each of said transmit antennas*". However, such limitations lack thereof from Paulraj reference are well known in beamforming network and spatial multiplexing systems and disclosed by Vook.

In the same field of endeavor, Vook discloses a base station/subscriber unit (*see '327, Fig. 9 and col. 12, lines 31-37*) comprising a weighting unit (1002) for weighting the input signals and a combiner (1004) for combining the weighted signals for transmission to maximize efficiency (*see '327, col. 2, line 21*). The forming a plurality of weighted antenna output signals based on at least two covariance matrices and two steering vectors determined from the pilot symbols (*see abstract and thereinafter*).

It would have been obvious to those skilled in the art at the time of the invention was made to implement Vook's teaching into Paulraj's system to arrive the claimed invention with a motivation to maximize efficiency.

Regarding **claim 11**, in addition to features recited in base claim 10 (see rationales discussed above), Paulraj in view Vook further discloses a digital to analog converter for converting each of said combined weighted substreams (*see Fig. 6; elements 120, 122 and 124 corresponding to digital to analog converte*r).

Regarding **claim 12**, in addition to features recited in base claim 10 (see rationales discussed above), Paulraj in view Vook further discloses an upconverter for converting to radio frequencies each of said analog-converted combined weighted substreams (*see Fig. 6; UP-CONV. RF AMP.*).

Regarding **claim 13**, in addition to features recited in base claim 10 (see rationales discussed above), Paulraj in view of Vook further discloses wherein said weights are determined by said transmitter in response to said interference covariance matrix estimate and said estimate of the forward channel response of receiver via said reverse channel (*see' '327, Fig. 11 and '499, Fig. 3; element 64*).

Regarding **claim 14**, in addition to features recited in base claim 10 (see rationales discussed above), Paulraj in view Vook further discloses wherein said weighted are determined in said receiver and are transmitted to said transmitter over said reverse channel (*see '327, Figs. 9-10 and "499, Fig. 3; element 64*).

Regarding **claim 16**, in addition to features recited in base claim 10 (see rationales discussed above), Paulraj in view Vook further discloses wherein said

transmitter and said receiver communicate using TDD and said weights are determined in said transmitter using an estimate of the forward channel response that is determined by a receiver of said reverse link for said transmitter (*see '499, col. 7, lines 7-8, col. 8, lines 47-67 and '327, Figs. 9-11 and col. 12, line 31 to col. 13, line 16*).

Allowable Subject Matter

4. Claims 21-22 are allowed.

5. Claims 5 and 15-16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

6. Applicant's arguments filed 1/5/04 have been fully considered but they are not persuasive. Applicants' arguments will be addressed hereinbelow in the order in which they appear in the response filed 1/5/04.

In the Remarks of the outstanding response, on page 11, pertaining the rejection of claims 1-4, 6-14 and 17-19, Applicants state "*Alls of applicants' claims that are rejected based on prior art, as now presented, recite the use of interference covariance matrix to compute the weights*" and argue "*None of the cited references teaches to employ interference covariance matrix in computing the weights. It should be noted that while some of the references compute the covariance matrix of signals, that is quite different from the interference covariance matrix*".

In response Examiner respectfully disagrees and contends the prior art does teach the disputed limitation and the claimed inventions as clearly pointed out in the Office Action. Examiner understands the Applicant is his or her own lexicographer. Nevertheless, the claimed terms/limitations are subjected to Examiner's broadest, reasonable interpretation of the applied reference(s), unless the terms/limitations are specifically defined to exclude teaching of the applied reference. A careful review the claims Examiner finds no specific definition for the term "interference covariance matrix". Thus, Examiner has properly given the disputed term the broadest, reasonable interpretation against the prior art.

On page 11 of the Remarks, Applicants further state "*All of the cited references are limited to environments where the noise is considered to be white noise. However, use of the interference covariance matrix, as recited in applicants' claims, allows the invention to be employed in an environment in which the noise is white*".

In response Examiner again respectfully disagrees. A careful review of the claims Examiner finds no such language in the claims. Perhaps applicants refer to certain features that are disclosed in the present application but not recited in the rejected claims in making the contention that the Whinnett or Paulraj in view of Vook references fail to show certain feature of Applicants' invention. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. *See In re Van Geuns, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).*

Applicants are strongly urged to either further define the disputed term or incorporate the objected claim into the rejected base claims in a response to this Office Action to present the claimed invention in better form for allowance.

Examiner believes an earnest attempt has been made in addressing all of the Applicants' arguments. Due to the amendment fails to place the application in better form for allowance and the arguments are not persuasive, the rejection from the last Office Action is maintained.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Baltersee, Smart Antennas and Space-Time Processing, pages 1-55, May 8, 1998.

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Frank Duong whose telephone number is (703) 308-5428. The examiner can normally be reached on 7:00AM-3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Seema Rao can be reached on (703) 308-5463. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Frank Duong
Examiner
Art Unit 2666

March 25, 2004